

CLAIMS

1. A method for locating bearing anomalies in machinery, which comprises:

5 receiving vibration measurements acquired from the machinery,
analysing the vibration measurements to identify novel tracked orders indicative of bearing anomalies, and
ascertaining the location of a bearing anomaly by relating a novel tracked order thus-identified to one or more
10 further tracked orders.

2. A method according to claim 1, wherein the further tracked orders comprise at least one side-band to the novel tracked order.

3. A method according to claim 1 or 2, wherein the further
15 tracked orders comprise a tracked order associated with a component supported by the anomalous bearing.

4. A method for detecting bearing anomalies in machinery, which comprises performing at each of a plurality of times the steps of:

20 constructing a condition signature from a plurality of condition indicators including (a) a plurality of vibration measurements acquired from the machinery or (b) one or more vibration measurements and one or more performance parameter measurements acquired from the machinery;

25 predicting a normal signature corresponding to the condition signature for the machinery without bearing anomalies;

comparing the condition signature with the normal signature; and

30 registering a bearing anomaly if the condition signature

differs from the normal signature by more than a predetermined threshold.

5. A method according to claim 4, wherein the normal signature is predicted from a model defining one or more inter-dependencies between the condition indicators.
6. A method according to claim 5, wherein the model is a learnt model.
7. A method according to claim 5 or 6, wherein the model comprises a matrix with one or more non-zero off-diagonal terms to define said inter-dependencies.
8. A method according to claim 7, wherein the step of comparing the condition signature with the normal signature involves calculating a value for the normalised innovations squared.
9. A method according to claim 5 or 6, wherein the model comprises a neural network.
10. A method according to claim 9, wherein the step of comparing the condition signature with the normal signature involves calculating a prediction error.
11. A method according to any one of claims 4 to 10, wherein said times define successive intervals of at most 1 sec duration.
12. A method according to any one of the previous claims, wherein the machinery comprises a gas turbine engine.
13. A data processing system for locating bearing anomalies in machinery, comprising:
 - a data receiver for receiving vibration measurements acquired from the machinery, and

a processor for (a) analysing the vibration measurements to identify novel tracked orders indicative of bearing anomalies, and (b) ascertaining the location of a bearing anomaly by relating a novel tracked order thus-identified to one or more further tracked orders.

14. A data processing system for detecting bearing anomalies in machinery, comprising:

data acquisition devices for acquiring a plurality of condition indicators from the machinery at each of a plurality of times, the condition indicators including (a) a plurality of vibration measurements or (b) one or more vibration measurements and one or more performance parameter measurements;

a processor for constructing a condition signature from said vibration measurements and for predicting a normal signature corresponding to the condition signature for the machinery without bearing anomalies;

a comparator for comparing the condition signature with the normal signature; and

a register for registering a bearing anomaly if the comparator indicates that the condition signature differs from the normal signature by more than a predetermined threshold.